

WHAT IS CLAIMED IS:

1 1. A wavelength multiplex optical communication module
2 comprising;

3 a light emitting device disposed on an optical waveguide
4 substrate;

5 a first optical waveguide for guiding signal light with a
6 first wavelength output from said light emitting device;

7 a second optical waveguide that has a path connecting one
8 end face of the optical waveguide substrate to the other end
9 face of the optical waveguide substrate and has a portion of
10 the waveguide, between both ends of the path, which is disposed
11 closely to the first optical waveguide to constitute a
12 directional coupler for transferring the power of the signal
13 light with a first wavelength at a predetermined ratio to the
14 second optical waveguide;

15 a wavelength filter disposed at said other end face of
16 the optical waveguide substrate, for reflecting the signal
17 light with a first wavelength and, in addition, permitting
18 signal light with a second wavelength different from the first
19 wavelength to be transmitted therethrough;

20 a third optical waveguide that has a path connecting one
21 end face of the optical waveguide substrate to the other end
22 face of the optical waveguide substrate and is disposed in such
23 a manner that the end of the third optical waveguide and the
24 end of the second optical waveguide face the wavelength filter
25 on said other end face side of the optical waveguide substrate
26 so that, according to reflecting characteristics of the

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wavelength filter with respect to a predetermined wavelength, a reflected light, which has been guided through the second optical waveguide and reflected from the wavelength filter, is coupled to the third optical waveguide while a reflected light, which has been guided through the third optical waveguide and reflected from the wavelength filter, is coupled to the second optical waveguide; and

an out-of-substrate photodetector that is provided outside the optical waveguide substrate so as to face said other end face of the optical waveguide substrate through the wavelength filter and receives the signal light with a second wavelength which has passed through the wavelength filter.

2. The wavelength multiplex optical communication module according to claim 1, wherein signal light with second and third wavelengths is guided from said one end face side of the second optical waveguide through the second optical waveguide.

3. The wavelength multiplex optical communication module according to claim 1, wherein the wavelength filter reflects signal light with a third wavelength different from the first and second wavelengths, the signal light with a third wavelength is guided through the third optical waveguide toward said other end face, and the signal light with a third wavelength and the signal light with a first wavelength are output from the second optical waveguide and led to the outside of the module.

1 4. A wavelength multiplex optical communication module
2 comprising:

3 an on-substrate photodetector disposed on an optical
4 waveguide substrate;

5 a second optical waveguide which has a path connecting
6 one end face of the optical waveguide substrate to the other
7 end face of the optical waveguide substrate and guides signal
8 light with first to third wavelengths different from one
9 another;

10 a first optical waveguide that has a portion disposed
11 closely to the waveguide portion in the second optical
12 waveguide to constitute a directional coupler for transferring
13 the power of signal light with a first wavelength at a
14 predetermined ratio to the second optical waveguide and the end
15 of a guide front of the signal light with a first wavelength is
16 optically connected to the on-substrate photodetector;

17 a wavelength filter disposed at said other end face of
18 the optical waveguide substrate, for reflecting the signal
19 light with a first wavelength and, in addition, permitting
20 signal light with a second wavelength different from the first
21 wavelength to be transmitted therethrough;

22 a third optical waveguide that has a path connecting one
23 end face of the optical waveguide substrate to the other end
24 face of the optical waveguide substrate and is disposed in such
25 a manner that the end of the third optical waveguide and the
26 end of the second optical waveguide face the wavelength filter
27 on said other end face side of the optical waveguide substrate
28 so that, according to reflecting characteristics of the

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29 wavelength filter with respect to a predetermined wavelength, a
30 reflected light, which has been guided through the second
31 optical waveguide and reflected from the wavelength filter, is
32 coupled to the third optical waveguide while a reflected light,
33 which has been guided through the third optical waveguide and
34 reflected from the wavelength filter, is coupled to the second
35 optical waveguide; and

36 an out-of-substrate photodetector that is provided
37 outside the optical waveguide substrate so as to face said
38 other end face of the optical waveguide substrate through the
39 wavelength filter and receives the signal light with a second
40 wavelength which has passed through the wavelength filter.

1 5. A wavelength multiplex optical communication module
2 comprising:

3 a light emitting device disposed on an optical waveguide
4 substrate;

5 a first optical waveguide for guiding signal light with a
6 first wavelength output from said light emitting device;

7 a second optical waveguide that has a path connecting one
8 end face of the optical waveguide substrate to the other end
9 face of the optical waveguide substrate and has a portion of
10 the waveguide, between both ends of the path, which is disposed
11 closely to the first optical waveguide to constitute a
12 directional coupler for transferring the power of the signal
13 light with a first wavelength at a predetermined ratio to the
14 second optical waveguide;

15 a wavelength filter disposed at said other end face of

16 the optical waveguide substrate, for permitting the signal
17 light with a first wavelength to be transmitted therethrough
18 and, in addition, reflecting signal light with a second
19 wavelength different from the first wavelength;

20 a third optical waveguide that has a path connecting one
21 end face of the optical waveguide substrate to the other end
22 face of the optical waveguide substrate and is disposed in such
23 a manner that the end of the third optical waveguide and the
24 end of the second optical waveguide face the wavelength filter
25 on said other end face side of the optical waveguide substrate
26 so that, according to reflecting characteristics of the
27 wavelength filter with respect to a predetermined wavelength, a
28 reflected light, which has been guided through the second
29 optical waveguide and reflected from the wavelength filter, is
30 coupled to the third optical waveguide while a reflected light,
31 which has been guided through the third optical waveguide and
32 reflected from the wavelength filter, is coupled to the second
33 optical waveguide; and

34 an out-of-substrate photodetector that is provided
35 outside the optical waveguide substrate so as to face said
36 other end face of the optical waveguide substrate through the
37 wavelength filter and receives the signal light with a first
38 wavelength which has passed through the wavelength filter.

1 6. A wavelength multiplex optical communication module
2 comprising:

3 a light emitting device disposed on an optical waveguide
4 substrate;

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an on-substrate photodetector disposed on the optical waveguide substrate;

a first optical waveguide for guiding signal light with a first wavelength output from said light emitting device;

a second optical waveguide that has a path connecting one end face of the optical waveguide substrate to the other end face of the optical waveguide substrate and has a portion of the waveguide, between both ends of the path, which is disposed closely to the first optical waveguide to constitute a directional coupler for transferring the power of the signal light with a first wavelength at a predetermined ratio to the second optical waveguide;

a wavelength filter disposed at said other end face of the optical waveguide substrate, for reflecting the signal light with a first wavelength and, in addition, permitting signal light with a second wavelength different from the first wavelength to be transmitted therethrough;

a third optical waveguide that has a path leading from the on-substrate photodetector to the other end face of the optical waveguide substrate and is disposed in such a manner that the end of the third optical waveguide and the end of the second optical waveguide face the wavelength filter on said other end face side of the optical waveguide substrate so that, according to reflecting characteristics of the wavelength filter with respect to a predetermined wavelength, a reflected light, which has been guided through the second optical waveguide and reflected from the wavelength filter, is coupled to the third optical waveguide while a reflected light, which

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33 has been guided through the third optical waveguide and
34 reflected from the wavelength filter, is coupled to the second
35 optical waveguide; and

36 an out-of-substrate photodetector that is provided
37 outside the optical waveguide substrate so as to face said
38 other end face of the optical waveguide substrate through the
39 wavelength filter and receives the signal light with a second
40 wavelength which has passed through the wavelength filter.

1 7. The wavelength multiplex optical communication module
2 according to claim 1, wherein a monitoring photodetector for
3 receiving light output from the light emitting device is
4 disposed on the optical waveguide substrate in its position
5 behind the light emitting device provided on the optical
6 waveguide substrate.

1 8. The wavelength multiplex optical communication module
2 according to claim 5, wherein a monitoring photodetector for
3 receiving light output from the light emitting device is
4 disposed on the optical waveguide substrate in its position
5 behind the light emitting device provided on the optical
6 waveguide substrate.

1 9. The wavelength multiplex optical communication module
2 according to claim 6, wherein a monitoring photodetector for
3 receiving light output from the light emitting device is
4 disposed on the optical waveguide substrate in its position
5 behind the light emitting device provided on the optical

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6 waveguide substrate.

10. The wavelength multiplex optical communication module according to claim 1, wherein a monitoring photodetector for receiving light output from the light emitting device is disposed, so as to face the light emitting device disposed on the optical waveguide substrate, in a region on the outside of the optical waveguide substrate wherein the wavelength filter is not interposed between the light emitting device and the monitoring photodetector.

11. The wavelength multiplex optical communication module according to claim 5, wherein a monitoring photodetector for receiving light output from the light emitting device is disposed, so as to face the light emitting device disposed on the optical waveguide substrate, in a region on the outside of the optical waveguide substrate wherein the wavelength filter is not interposed between the light emitting device and the monitoring photodetector.

12. The wavelength multiplex optical communication module according to claim 6, wherein a monitoring photodetector for receiving light output from the light emitting device is disposed, so as to face the light emitting device disposed on the optical waveguide substrate, in a region on the outside of the optical waveguide substrate wherein the wavelength filter is not interposed between the light emitting device and the monitoring photodetector.

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1 13. The wavelength multiplex optical communication module
2 according to claim 1, wherein the wavelength filter is applied
3 to the end face of the optical waveguide substrate.

1 14. The wavelength multiplex optical communication module
2 according to claim 3, wherein the wavelength filter is applied
3 to the end face of the optical waveguide substrate.

1 15. The wavelength multiplex optical communication module
2 according to claim 4, wherein the wavelength filter is applied
3 to the end face of the optical waveguide substrate.

1 16. The wavelength multiplex optical communication module
2 according to claim 5, wherein the wavelength filter is applied
3 to the end face of the optical waveguide substrate.

1 17. The wavelength multiplex optical communication module
2 according to claim 6, wherein the wavelength filter is applied
3 to the end face of the optical waveguide substrate.

1 18. The wavelength multiplex optical communication module
2 according to claim 11, wherein the wavelength filter is applied
3 to the end face of the optical waveguide substrate.

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